

ASSESSMENT OF THE NATIONAL NANOTECHNOLOGY INITIATIVE

Statement of

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and

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before the

Committee on Commerce, Science and Transportation
U.S. Senate

SEPTEMBER 17, 2002

Good morning, Mr. Chairman and members of the Committee. My name is Samuel Stupp. I am Board of Trustees Professor of Materials Science, Chemistry and Medicine at Northwestern University, and chaired the Committee for the Review of the National Nanotechnology Initiative of the National Research Council. The Research Council is the operating arm of the National Academy of Sciences, National Academy of Engineering, and the Institute of Medicine, chartered by Congress in 1863 to advise the government on matters of science and technology.

I am here representing a committee that was composed of a mix of individuals from academe and industry, and drawn from a variety of scientific and engineering disciplines relevant to the topic of nanoscience and nanotechnology. The committee spent nine months reviewing the National Nanotechnology Initiative or NNI, and writing the report that is the basis of my testimony to you today. During those nine months, we heard from all of the agencies currently being funded under the NNI, and most of the agencies that are planning on joining in the NNI in the near future. In addition to the information gathered from these agencies, we also relied on the knowledge committee members have about activities on-going in our universities, in the private sector, in state and local regions, and internationally.

The committee was asked to review the NNI with particular attention to

- Whether the balance of the overall research portfolio is appropriate,
- Whether the correct “seed” investments were being made now to assure US leadership in nanoscale work in the future,
- Whether partnerships were being used effectively to leverage the federal investment in this

area, and

- Whether the coordination and management of the program is effective, such that “the whole is greater than the sum of its parts.”

In writing its report, the committee was very concerned with communicating to the reader the importance of nanotechnology and its future potential. There have been a lot of promises made for the wonders which nanotechnology will provide for society, and while there has been hype, the committee can say definitively that nanoscience and nanotechnology are not dreams but are here today in products and technologies we currently use. You already use nanotechnology everyday in applications as mundane as the sunscreen and lipstick you may be wearing, to those as sophisticated as the high-density hard disk that runs your pc or laptop. Current research results point to even more applications in the near future, such as improved medical diagnostics and new therapies for disease and injury.

The committee found that the agencies participating in the NNI have made a good start in organizing and managing such a large interagency program. The committee was impressed with the leadership and level of multi-agency involvement in the NNI, particularly the leadership role played by the National Science Foundation. Programs funded to date that were presented to the committee were all of an appropriately high technical merit, and the participating agencies have sponsored a number of influential symposia in nanoscale science and technology, including one on the potential ethical, legal, and social issues involved in these technical advances.

The committee formulated ten major recommendations to help the NNI-participating

agencies build on the foundation of their efforts to date to further strengthen the implementation of the initiative.

Concerning the balance of the research portfolio, the committee recommended that

- More emphasis be given to long-term funding of new concepts in nanoscale science and technology. Truly revolutionary ideas will need sustained funding to achieve results and produce important breakthroughs. There are not currently enough funding mechanism to give longer-term support to higher risk but potentially groundbreaking ideas.
- The committee recommends increasing the multiagency investments in research at the intersection of nanoscale technology and biology. We can already see applications of nanoscale science and technology that will have significant impacts in biotechnology and medicine. “Bio-nano” is not currently as well represented in the NNI portfolio as it should be. Since many of the advances foreseen in this area involve the marriage of physical sciences and engineering with biology, these investments should focus on collaborations between NIH and the other NNI agencies.
- The committee recommends investment in the development of new instruments for measurement and characterization of nanoscale systems. Historically, many important advances in science happened only after the appropriate investigative instruments became available. Since one must be able to measure and quantify a phenomenon in order to understand and use it, it is critical that we develop

tools that allow for more quantitative investigations of nanoscale phenomena.

- The committee recommends that NSET develop a new funding strategy to ensure that the societal implications become an integral and vital component of the NNI. The current level and diversity of efforts concerning societal implications of nanotechnology is disappointing. Federal agencies have not given sufficient consideration to societal implications of nanoscale science and technology. To ensure that work in this area is funded, the participating agencies should develop a funding strategy that treats societal implications as a supplement or set-aside to agency core budget requests, which is then awarded to agencies willing and capable to engage in this type of work.

On whether the correct “seed” investments are being made now for the future of US leadership in nanoscale science and technology, the committee recommends

- That NNI agencies provide strong support for the development of an interdisciplinary culture for nanoscale science and technology. Nanoscale research is leading us into areas involving the convergence of many disciplines—biology, chemistry, physics, materials science, mechanical engineering, and others. However, the overall value system used by the scientific community to judge its members continues to discourage interdisciplinary research. Although the number of interdisciplinary research groups will grow as it becomes evident that this approach is necessary to make

the most exciting advances in nanoscale research, federal agencies should accelerate this process by developing creative programs that encourage interdisciplinary research groups in academia.

Looking at the question of whether partnerships are being used effectively in the NNI, the committee found that

- Industrial partnerships need further stimulation and nurturing to accelerate the commercialization of NNI developments. The US is most likely to realize economic benefits from nanoscale science and technology when this technology and its underlying intellectual property come from US-based laboratories, institutions, and corporations.
- Interagency partnerships also require further attention. While the NNI Implementation Plan lists major interagency collaborations, the committee had no sense that there is any common strategic planning occurring in those areas, any significant interagency communication between researchers working in those areas, or any significant sharing of results before publication in the open literature. All NNI funds are currently directed by each agency to the projects and programs of that agency's choice. To stimulate meaningful interagency collaborations, the committee recommends the creation of a special fund within NNI, perhaps under the oversight of the Office of Science and Technology Policy (OSTP), for grants to exclusively support interagency research

programs.

On the topic of program management and evaluation, the committee recommends

- That NSET, the Nanoscale Science, Engineering and Technology subcommittee of the National Science and Technology Council, develop a crisp, compelling, overarching strategic plan for the NNI. This plan should articulate short, medium, and long-term goals, and emphasize those long-range goals that move results out of the laboratory and into society. In particular, the strategic plan should include a consistent set of anticipated outcomes for each funding theme and each Grand Challenge in the NNI implementation plan.
- The committee recommends that NSET develop performance metrics to assess the effectiveness of the NNI in meeting its objectives and goals. Currently the programs have only been evaluated as part of the GPRA procedures of individual agencies.
- Finally, the committee recommends that OSTP establish an independent standing Nanoscience and Nanotechnology Advisory Board (NNAB). The existence of such a board would help give the NSET agencies vision beyond their own individual missions. It could identify and champion research opportunities that don't fit conveniently into any one agency's mission to ensure that nanoscale science and engineering continue to progress toward their ultimate potential. Such a board should be composed of leaders from industry and academia with scientific, technical, social science, or research management credentials.

With this, I will be happy to take your questions on the report and its findings.